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DRAWINGS ATTACHED

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(54) SCREW-THREADED NUTS

(71) We, YORKSHIRE IMPERIAL METALS LIMITED, a British Company, of Haigh Park Road, Stourton, Near Leeds, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to screw threaded nuts and in particular to nuts used in connection with plumbing and pipe fittings made from plastics material.

Plastics materials are increasingly being used in piping and plumbing fittings in place of conventional metal fittings and certain kinds of fittings require one or more nuts to secure pipes in position. It is frequently necessary to use some form of packing or sealing material to ensure fluid tightness of a joint made with such fittings and customarily, fibrous packing or rubber sealing rings are used in the interior of the nut so that action of tightening up the nut compresses the sealing material.

With the use of plastics such as acetal copolymer, which has a lower coefficient of friction than brass, it has been found in practice that sufficient torque may be applied to the nut by a spanner or wrench to extrude the sealing material through the gap between the pipe and the rear face of the nut thus reducing the effectiveness of the sealing material.

According to the present invention, a nut comprises an internally threaded body formed with opposite portions of its peripheral surface adapted for engagement with the gripping surfaces of a spanner, part of at least one spanner-engaging portion being undercut to provide a deflectable cantilever, the free end of which is located to form a leading edge during rotational movement of the nut to cause either screwing or unscrewing, and the length and thickness of the cantilever being such that when a predetermined torque applied by the gripping surfaces of a spanner is exceeded, the cantilever is deflected sufficiently for the gripping surfaces to lose their grip on the nut.

Whilst the nut can be made from metal if desired, preferably the nut is made from acetal copolymer and conveniently it may be manufactured by injection moulding processes. In the preferred form of the nut, the cantilevers deflect elastically and the nut can, therefore, be re-used.

The invention is based on the observation that when a spanner is used to rotate a nut, the jaws of the spanner bear principally on the part of the flats of the nut which is the forward portion relative to the direction of rotation. This is due to the necessarily somewhat loose fit of the spanner on the nut to permit of easy engagement. The applied force is concentrated in two relatively small areas when a simple open ended spanner is used, and we have found over-tightening of the nut can be prevented by constructing the nut so that these areas deflect when the applied force exceeds that necessary for correct tightening and cause the spanner to lose its grip. In effect, the combined deflection is equivalent to reducing the distance across flats so that the spanner no longer fits the nut and consequently slips over the corner between adjacent flats.

The load bearing areas can be satisfactorily constructed to deflect at a given load by under-cutting all or part of the area to form a cantilever having a length and a thickness which will deflect a given distance under the load. By calculation, or by trial and error, the length and thickness are arranged to be such that the combined deflection of the cantilevers under the maximum permissible torque is equal to the difference between the distance between the flats of the spanner jaw and the distance between the diametrically opposite corners of the nut, the deflection for each cantilever being one half of this difference. The load at which each cantilever reaches this deflection depends upon whether an open ended spanner or a ring or box spanner is used; with an open ended spanner the whole torque is transmitted through two cantilevers and with a box spanner, through six in the case of a hexagonal nut. The under-cut or recess by which the cantilever is formed has to be

[*Price 25p*]

sufficiently wide to permit full deflection to take place.

Where a nut is to be used only with an open ended spanner, a modification of the nut construction can be used in which one cantilever is provided for each opposite pair of spanner engaging portions or flats, the cantilever in such a case being formed by a recess large enough to permit sufficient deflection to occur for the spanner to slip off the nut at one corner only. With a hexagonal nut only three cantilevers, arranged preferably in alternate sides, are required in such a modification.

In order to increase the clearance between the jaws of the spanner and the peripheral surface of the nut, the surface may be relieved so as not to intersect or coincide with the plane joining the corners at the intersection of the sides of the nut. The free end of the cantilever on the adjacent peripheral surface then projects slightly above the relieved surface and provides a bearing surface for the jaws of the spanner in the event of it being necessary to unscrew a nut.

The invention is particularly useful for nuts employed in pipe installations, especially in all-plastics systems and by way of example, an embodiment of the invention as applied to plastics nuts suitable for use with a pipe coupling or other pipe fitting will now be described with reference to the accompanying drawing of which:

Figure 1 is a front elevation of a hexagonal nut;

Figure 2 is a side elevation in cross-section, and

Figure 3 is an elevational view of a portion of a nut having relieved sides.

The body 1 is a moulded acetal copolymer hexagon of standard size for pipe fitting nuts and is pierced by a right-hand threaded bore 2 reduced in diameter at the face of the nut by the shoulder 3. The body 1 is laterally bounded by the flats 4, by which the nut is engaged for rotation by the jaws of a spanner.

In each of the flats 4 is a recess 5 extending between the two faces 6 and 7 thus forming a cantilever 8. The width of the recess 5 is sufficient to permit the required amount of deflection of the free end 9 of cantilever 8 without closing the mouth of the recess. The length of the cantilever 8, as determined by the depth of the recess 5, and the thickness, are proportioned so as to allow the cantilever to deflect into the recess 5, under a force greater than the desired maximum torque, a distance such that the dimension 'X' in Figure 1 becomes equal to or less than the perpendicular distance between the jaws of a standard spanner fitting the nut.

In use, the nut is provided in the bore 2 with sealing material such as a rubber 'O' ring 10, a pipe 11 passing through the bore into a pipe fitting 12 onto which the bore is screwed. The jaws of a spanner engage with opposite flats 4 and the nut is rotated in a clockwise direction. When the resistance to rotation of the nut increases due to the trapping of the sealing material between the abutment 3 and the pipe fitting 12, the torque applied by the spanner increases with the result that the cantilevers 8 are proportionally inwardly deflected. As soon as the 'O' ring 10 is fully compressed the torque required to achieve further rotation increases greatly to deflect the cantilevers 8 to a degree such that the dimension 'X' becomes small enough for the jaws of the spanner to slip over the deflected surface of the cantilevers and thus lose their grip on the nut. When the applied force is removed, the cantilever is restored to its original position.

Should it be necessary to unscrew the nut, the position of the jaws of the spanner being reversed, the force applied is concentrated at the opposite end of the flats 4 bearing on the free end of the cantilever 8, which is placed in compression and is not significantly deflected. Maximum torque is exerted to effect commencement of rotation of the nut and the torque falls rapidly thereafter.

Whilst, in the drawings, the recess 5 is shown as being parallel to the surface of the flat 4, it may also be arranged at a small angle to the said surface.

A further embodiment is shown in Figure 3 in which the body 1 is bounded by surfaces 13 which are inclined at a small angle to the plane joining the corners 14. The inclined surface 13 terminates at its intersection with the recess 5 and the free end 9 of cantilever 8 projects above the plane containing the surface. In use, the jaws of the spanner bear on the corners 14 when tightening the nut and on the free end 9 of cantilevers 8 when unscrewing, as in the previously described embodiment, the effect being to increase the clearance between the spanner jaws and the peripheral surface of the nut. In a modification of the last described embodiment the surface 13 is non-planar and may, for example, curve between the corner 14 and the recess 5.

The invention is also applicable to nuts having cylindrical peripheral surfaces with 4 or 6 projections from the surface which are arranged to engage the jaws of a spanner. Such projections are usually half-cylindrical in shape, and in accordance with the invention, each half-cylinder or each alternate half-cylinder is cut away along its whole length to provide a recess analogous to the recess 5 in the previously described embodiments.

A nut in accordance with the invention which is screwed into position with the free ends of the cantilevers forming a trailing

edge with reference to the direction of rotation to effect tightening, cannot easily, if at all, be unscrewed with an open ended spanner. There is an advantage, therefore, in using such a nut in this way for safety or security applications.

WHAT WE CLAIM IS:—

1. A nut comprising an internally threaded body formed with opposite portions of its peripheral surface adapted for engagement with the gripping surfaces of a spanner, part of at least one spanner-engaging portion being undercut to provide a deflectable cantilever, the free end of which is located to form a leading edge during rotational movement of the nut to cause either screwing or unscrewing, and the length and thickness of the cantilever being such that when a predetermined torque applied by the gripping surfaces of a spanner is exceeded, the cantilever is deflected sufficiently for the gripping surfaces to lose their grip on the nut.

2. A nut as claimed in claim 1 in which alternate spanner engaging portions are each provided with a cantilever.

3. A nut as claimed in claim 1 or claim 2 in which the nut is cylindrical and the spanner engaging portions are constituted by projections on the cylindrical peripheral surface.

4. A nut as claimed in any of the preceding claims made from acetal copolymer.

5. A nut as claimed in any of the preceding claims in which the surface of each of the spanner engaging portions is relieved, whereby the free end of the cantilever projects above the surface of the adjacent spanner engaging portion.

6. A nut substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

7. A nut substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

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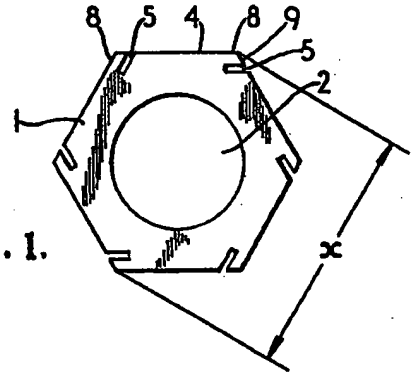

FIG. 1.

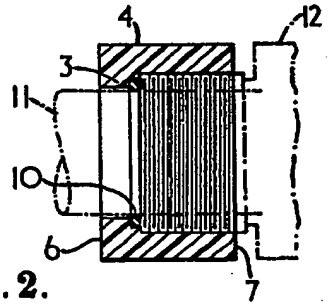

FIG. 2.

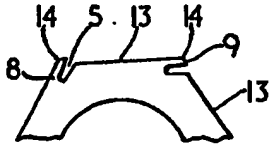

FIG. 3.